Providing an improved wind stress parameterization and QuikSCAT wind stress constraints for ECCO2

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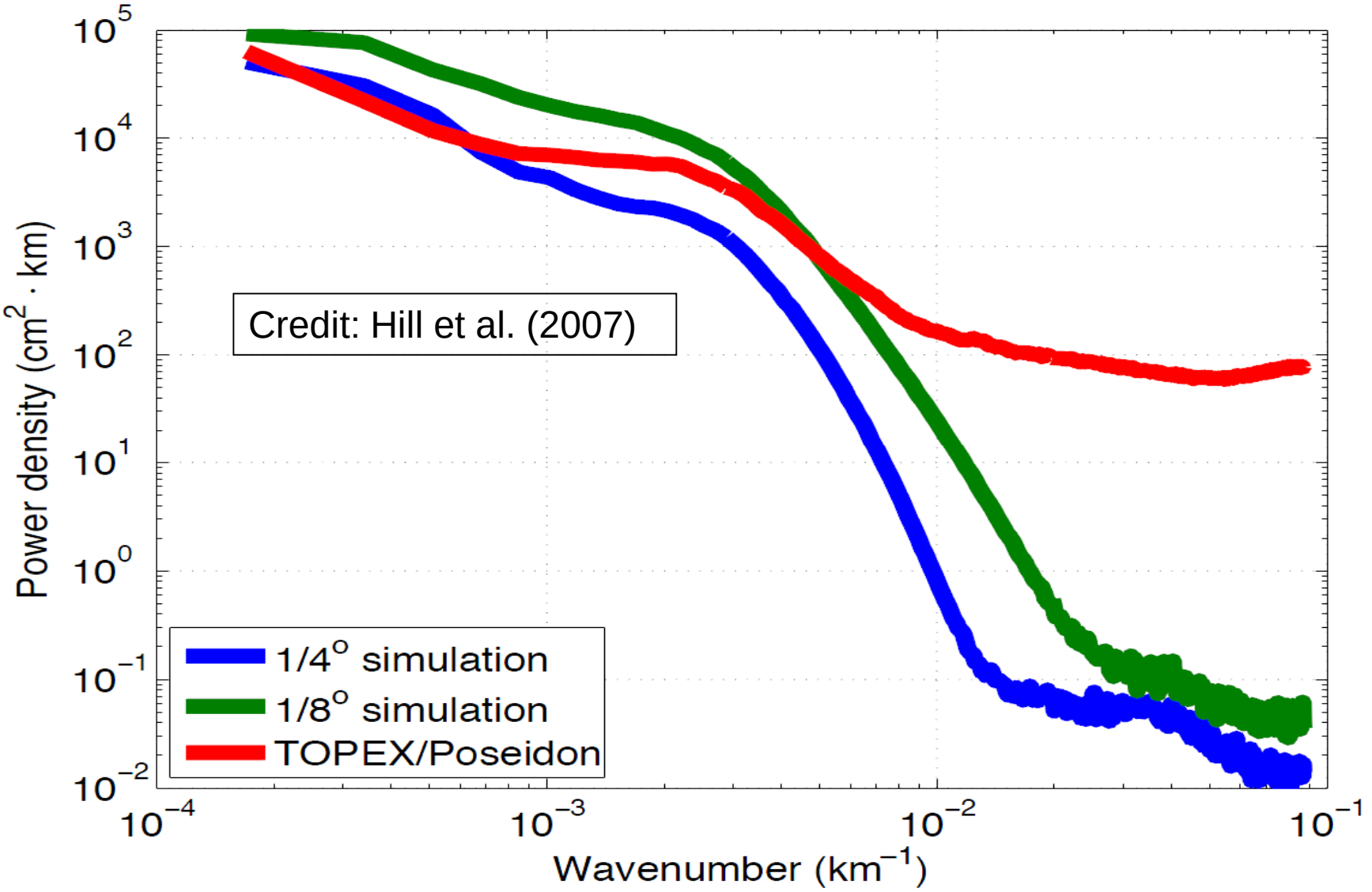
Motivation

- More than 10 years of QuikSCAT data are available at 90% global daily coverage provides exciting opportunity for improving the ECCO2 MITgcm.
- An improved, 'prototype' wind stress analysis product would have enormous impacts for both operations and research.
- Potential for optimizing of high resolution simulations.
- Potential contributions to the fundamental understanding of the physics and dynamics of oceanographic processes.

Objectives

1. Test an improved wind stress parameterization in MITgcm.
   - Run surface-relative and absolute wind integrations.
   - Compare with Large and Pond (1981) parameterization.
   - Compare all runs with QuikSCAT retrievals.
2. Incorporate improved parameterization into MITgcm.
3. Quantify model vs. data errors through comparisons of QuikSCAT-ECCO2 wind stress.
   - Requirement for assimilation.
4. Repeat 1/8° simulation (Hill et al. 2007) using both:
   - QuikSCAT wind stress constraints and
   - improved, sea-state-dependent (hypothetically ideal) surface wind stress parameterization.

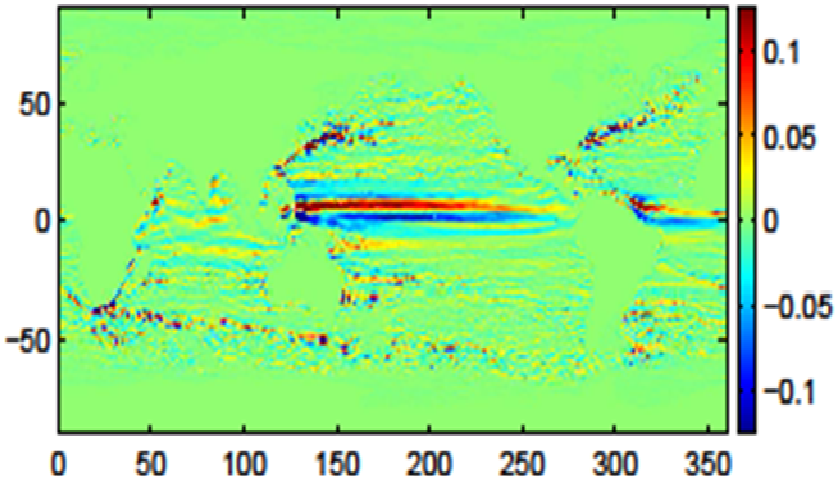
Power Spectrum: MITgcm vs. TOPEX



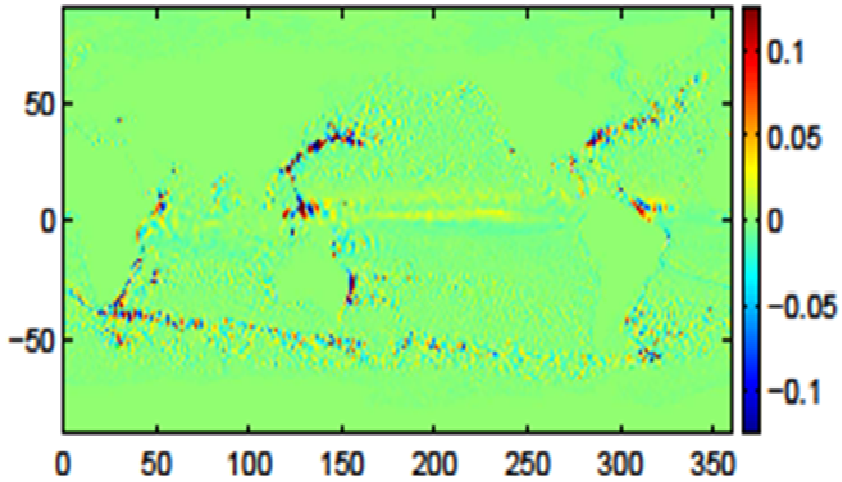
Relative vs. Absolute Wind

Mean Surface Velocities: 1992-2002

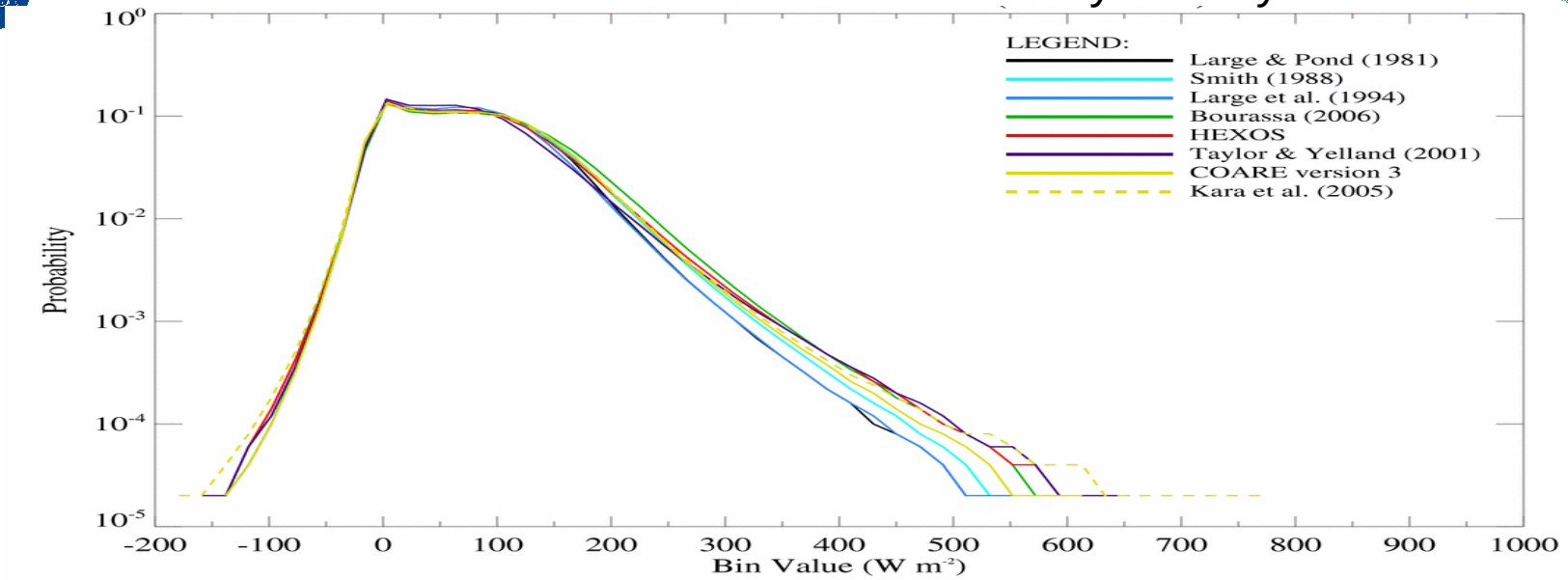
Zonal: Absolute – Relative



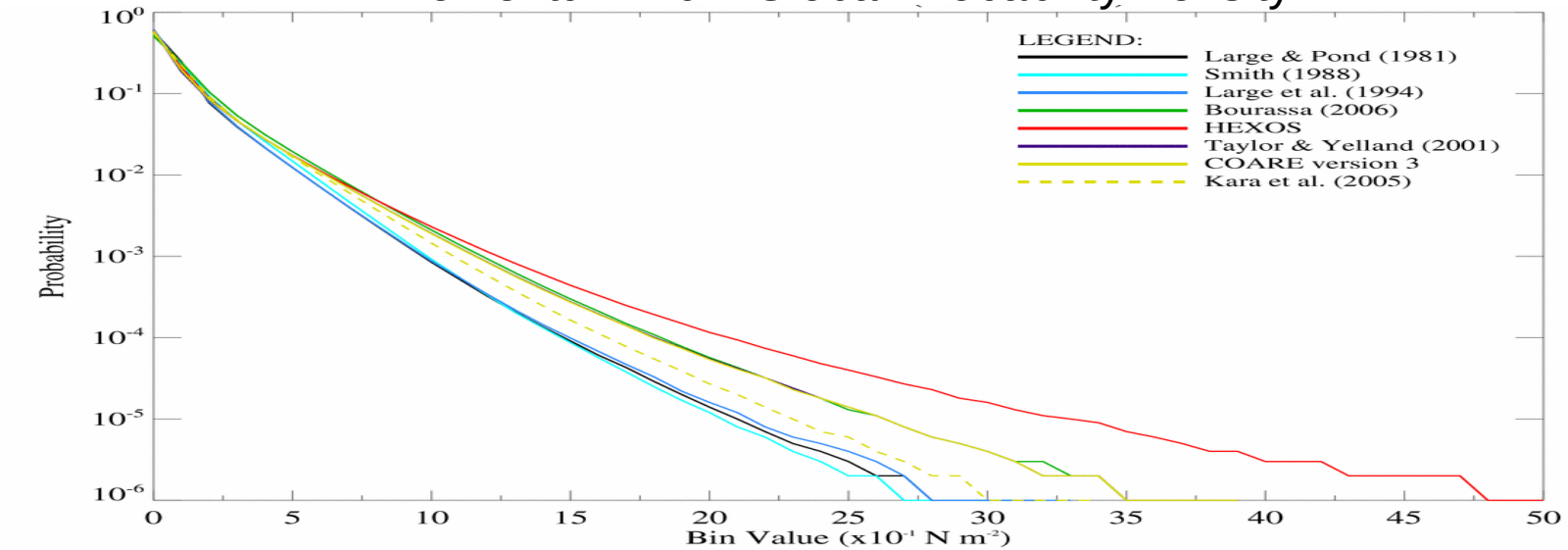
Meridional: Absolute – Relative



Latent Heat Flux: Global Probability Density

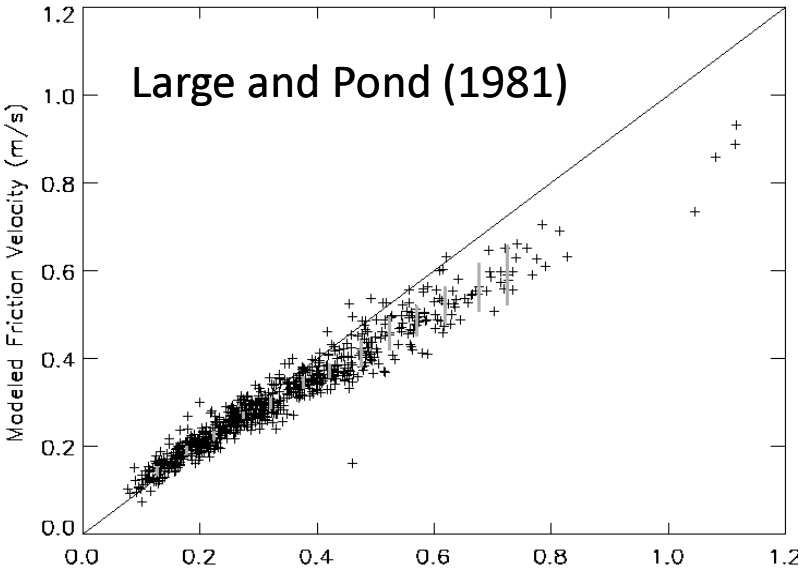


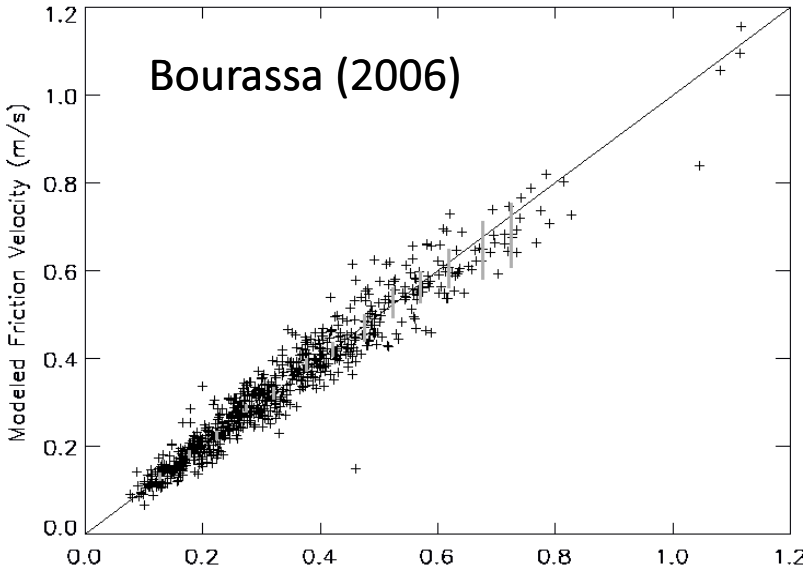
Momentum Flux: Global Probability Density



Comparisons to In Situ Stress

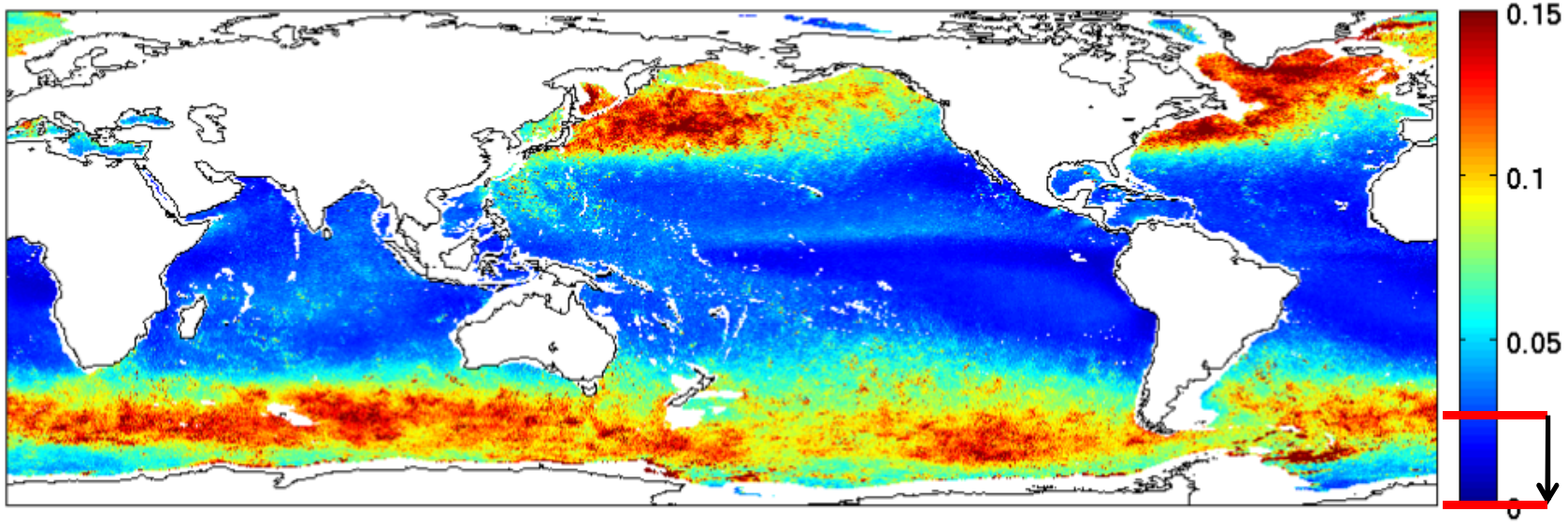
- Recent developments in sea-state dependent stress parameterizations have been adjusted to provide a better fit to in situ stress observations (Bourassa 2004, 2006):
- Created a 'prototype' QuikSCAT Level-2 wind stress retrieval product based on the Bourassa (2006) parameterization.





QuikSCAT-ECCO2 Inconsistencies

Zonal Stress RMS Difference (N m^{-2})



> 95% Data Errors Below 0.025 N m^{-2}

Concluding Remarks

- An improved 1/8° simulation would raise the bar for higher resolution simulations.
- Global, gridded stress fields from ECCO2 could be provided as an open-source analysis product.
  - Potential for climate studies and short-term forecasting applications.
  - Potential for cal/val with other OGCMs.
  - Potential for cal/val with current and future scatterometer stress GMF development.
- Re-estimation of wind work upon the ocean circulation, continuing in the direction of Wunsch (1998) and von Storch et al. (2007).


Thank you!